REMARKS/ARGUMENTS

Under the Office Action mailed on May 22, 2003, claims 1-25 were subject to examination. Claims 1-3, 6-7, 15-17, and 20-21 were rejected under 35 U.S.C. 102(b) as being anticipated by Le Saux, et al. (5,581,347); claims 4-5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Le Saux, et al.; and claim 12 was rejected under 35 U.S.C. 103(a) as being unpatentable over Le Saux, et al. in view of Bille (5,062,702). Claims 8-11, 13-14, 18-19, and 22-25 were found only objectionable, but otherwise allowable, if rewritten in independent form including all of the limitations of their base and any intervening claims. Claims 1-21 were additionally provisionally rejected for obviousness-type double patenting as being unpatentable over claims 1-21 of copending Application No. 09/328,972.

By way of the present amendment, claims 2, 4, 8, 9, 16, 21, 22, and 24 were canceled; those claims found objectionable, but otherwise allowable, have been rewritten in independent form as new claims 26-31 with certain dependent claims now made to depend from these new claims; claim 22 has been amended to incorporate the features of claim 21 and 22; and claim 1 has been amended to incorporate the features of claim 2 and 22; and claim 15 has been amended to incorporate the features of claim 16 and 22, noting that claims 1 and 15 as currently amended are now the apparatus analogs of currently amended claim 20, which has been indicated allowable.

The Present Invention

The invention comprises a system and method for automatically performing dynamic screen testing on a surface and determining its shape from which other optical parameters of interest may be derived and reported. A translatable measuring head, consisting of a source, beamsplitter, objective lens, and lens array with a CCD camera, is mounted on a translation stage that moves along the optic axis of the head relative to the part under test. The part under test is mounted on an appropriate support, such as a three-point support nest, that automatically centers spherical parts on the optical axis of the system.

As the head moves, light is projected along the optical axis through a microscope objective or other appropriate lens to illuminate the part under test with a predetermined wavefront, preferably spherical, so that subsequent calculations are

made simpler when this light is recollimated parallel to the optical axis of the system. Light reflected from the part under test as the part is scanned continuously passes back through the lens, after which it passes through a pellicle or cube beamsplitter towards a CCD camera. A two-dimensional array, preferably in the form of a pair of crossed lenticular screens, is placed in front of the CCD active area so that a series of sharp images are formed on the CCD array. When the system measuring head is positioned so that the focal point of the objective is located near the surface of the part under test, or near its center of curvature, the incoming nearly parallel light produces a series of spots on the CCD active area. The observed shifts in the pattern of spots as the part is scanned are used to determine the shape of the surface under test by relating the observed shifts to the local slope of the surface at a corresponding sampling point compared with the expected location. This is done by sampling over the surface at a number of different locations along the optical axis and expressing the angular deviation at each sample point as a second order polynomial. A least squares procedure is then performed to evaluate the polynomial coefficients and determine the surface shape. Mathematical analysis of this shape provides information on the radius of curvature of the part (if spherical), the "Spherical" and "Cylindrical" radii of curvature of a toric part (along with the angle between the major axes and a given reference axis), and the "Shape Factor" of an aspheric part. For ease of interpretation, the overall shape can be expressed in various ways, including Zernike polynomials. Software performs this analysis and facilitates providing results in many useful forms – contour plots, wire-frame models of deviation, direct readout of coefficients, direct readout of RMS surface form, direct readout of peak-to-valley difference, etc. Display screens are customizable for the engineering specialist or on-the-floor auditing and measurement for production. Custom processing capabilities are available using Visual Basic® and an Object Linking And Embedding (OLE®) interface.

The '102 Rejection Of Le Saux, et al.

Under 35 U.S.C. section 102, a claim is anticipated, and therefore unpatentable, when a single prior art reference discloses each and every element of the claimed invention. Structural Rubber Prods. Co. v. Park Rubber Co., 749 F.2d 707, 715, 223 U.S.P.Q. 1264, 1270 (Fed. Cir. 1984). If the reference fails to suggest even one limitation of the claimed invention, then the claim is not anticipated. Atlas

Powder Co. v. E.I. du Pont De Nemours & Co., 750 F.2d 1569, 1574, 224 U.S.P.Q. 409, 41 1 (Fed. Cir. 1984).

In rejecting independent claims 1, 15, and 20, the Office Action necessarily asserted that the Le Saux, et al. reference showed each and every one of the elements set forth in those claims. With all due respect, Applicant's disagree with this analysis of the contents of Le Saux, et al. as related to the elements of the rejected claims. First of all, Le Saux, et al. uses an altogether different measurement approach from that of the claimed invention, and its measurement scheme is implemented with structure that is also different. What Le Saux, et al. does is illuminate the part under test with a wavefront which is then directed by the part to a known Ronchi ruling or grating to generate what is known in the art as a Ronchigram that is manifested at a detector plane as a fringe pattern in which the illumination of the Ronchigram fringes vary in intensity. The fringe pattern contains information about the shape of the part, and the information must be extracted using rather complicated analytical mathematics about which Le Saux, et al. provides little detail. Le Saux, et al. emphatically does not scan the part with a known wavefront as claimed nor does it sample the distorted wavefront provided directly by the part (without an intervening modifying Ronchi screen) to determine local deformations of the surface responsible for angular shifts in the position of the sampled spots compared with their anticipated location. For these reasons alone, Le Saux, et al. does not meet the requirements of a sustainable '102 rejection, and it is respectfully requested that it be withdrawn.

Nevertheless, claims 1, 15 and 20 have been further amended to more particularly point out the invention by incorporating in all of them, among other things, the features of claims 21 and 22, which have been indicated allowable. Consequently, these claims should now be in immediate condition for allowance.

The rejection of dependent from claims 1, 15, and 20 under '102 as anticipated by Le Saux, et al. likewise suffer from the same legal frailties of Le Saux, et al. as a sufficient '102 reference and therefore should also be withdrawn.

'103 Rejections

Under 35 U.S.C. section 103, the subject matter of a claim is considered obvious, and therefore unpatentable, when the claimed "subject matter as a whole

would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The teachings of more than one reference may be considered in combination, but only when there is some teaching or suggestion to support their use in the combination. Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 E2d 281, 293, 227 U.S.P.Q. 657, 664 (Fed. Cir. 1985), *cert. denied,* 475 U.S. 1017 (1986); SmithKline Diagnostics, Inc. v. Helena Lab. Corp., 859 F2d 878,886-87, 8 U.S.EQ.2d 1468, 1475 (Fed. Cir. 1988).

The rejections of claims 4 and 5 as unpatentable in view of Le Saux, et al. rely on the interpretation given Le Saux, et al. to support the rejection under '102 as set forth above. Since the Le Saux, et al. reference as explained above is legally and factually wanting as a principal reference, it cannot be used to sustain the '103 rejection, and it is respectfully requested that this rejection be withdrawn, especially in view of the claims as now currently amended.

Claim 12 was rejected as being unpatentable over Le Saux, et al. in view of Bille. As discussed above the principal reference to Le Saux, et al. is legally faulty because its teachings and description were interpreted incorrectly.

The Bille '702 patent shows and describes a purely static system for mapping the topography of the cornea of an eye supported in the usual rather dynamic way within the head of its owner. The present invention, as previously and presently claimed, is a dynamic system in which a wavefront of predetermined shape is made to axially scan a test surface to be measured by being translated relative to that test surface such that the wavefront is returned in a distorted condition whose shape varies in accordance with, not only the topography of the test surface, but the relative axial positions of the test surface and the wavefront. It should be noted that, unlike the inherent support of Bille '702, the test surface of the invention preferably does not move with respect to its support. As the wavefront is made to axially scan the test surface, the distorted wavefront, which is changing as scanning takes place, is sampled at different axial locations, and the resultant data is analyzed in accordance with the mathematical schemes set forth in analytical detail in the specification. As explained in the specification, e.g., page 22, lines 6-11, this is done to reduce random errors in measurement and thus obtain a more accurate description of the test surface than otherwise is attainable by measuring at only one position, as advocated by Bille '702. There is nothing in Bille '702 to suggest such scanning, which is

believed to have been set forth in the claims as originally submitted, but even more so now with the claims as rewritten. Consequently, since neither Le Saux, et al. nor Bille are scanning systems, there is nothing in either of them to suggest combining any of their features one with the other.

Allowable Subject Matter

All claims indicated allowable if rewritten in independent form have been submitted in that form as new claims. New claim 26 is a combination of the features of original claims 1, 4, and 9; new claim 27 combines the features of original claims 1 and 8; new claim 28 combines the features of original claims 1, 12, and 13; new claim 29 combines the features of original claims 1 and 18; new claim 30 combines the features of original claims 1 and 19; and new claim 31 combines the features of original claims 20, 21, and 24. Claim 20 has been amended to incorporate the features of claims 20, 21, and 22. Dependent claims 10 and 11 have been amended to now depend form new claim 26, and dependent claim 25 to now depend from new claim 31. Since the examiner has acknowledged that these claims as currently drafted are directed to allowable subject matter, it is respectfully submitted that they are in condition for immediate allowance.

Claims 1 and 15 have been amended to incorporate the apparatus analog of the features of now allowable currently amended claim 20 so should likewise be allowable as directed to similar subject matter.

Double Patenting Rejection

It is respectfully requested that the provisional obviousness-type double patenting rejection be withdrawn because claims 1-21, as currently amended, are not drawn to subject matter that would unjustly extend the "right to exclude" if granted by an issued patent.

Accompanying Supplemental Prior Art Statement

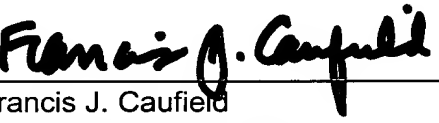
A supplemental prior art statement accompanies this response to remind the Examiner of the art applied in Patent Application No. 09/328,972 from which this application claimed benefit of priority. However, the principal Kuhel reference cited in the '972 application is not relevant as the Examiner contends because it is a system

that operates interferometrically by creating interferograms containing phase information from which information about surface topography must be extracted using phase analyses, mathematical procedures quite different from those described and advocated here.

In view of the above amendment and remarks, Applicants respectfully request that a timely Notice of Allowance be issued in this application.

Respectfully submitted,

October 16, 2003
Date



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